

CLAIMS

1. A plasma CVD film forming apparatus, characterized by comprising:

an external electrode being compatible with a vacuum chamber having a free space for accommodating a plastic container, the vacuum chamber being capable of accommodating the plastic container in the free space such that a container internal gas and a container external gas of the plastic container are not mixed with each other;

an internal electrode removably disposed at the inside of the plastic container in an insulated state from the external electrode;

container internal gas introducing means for introducing the container internal gas which is a source gas or a discharge gas to be generated as a plasma into the inside of the plastic container;

container external gas introducing means for introducing the container external gas which is a source gas or a discharge gas to be generated as a plasma into a sealed space which is the free space; and

high frequency supply means for supplying a high frequency to the external electrode.

2. A plasma CVD film forming apparatus, characterized by comprising:

an external electrode having a hollow shape with bottom having a free space for accommodating a plastic container and

having an opening in the vicinity of a mouth part of the plastic container when the plastic container is accommodated;

an internal electrode removably disposed at the inside of the plastic container;

a cover having a mouth part opening for causing a mouth part of the plastic container to be abutted in an intimate contact state and via an insulating body such that a container internal gas and a container external gas of the plastic container are not mixed with each other when the plastic container is accommodated in the free space, the cover supporting the internal electrode such that the internal electrode is in an insulated state from the external electrode and the internal electrode passes through the mouth part opening, and further sealing the opening to form the free space as a sealed space;

container internal gas introducing means for introducing the container internal gas which is a source gas or a discharge gas to be generated as a plasma into the inside of the plastic container;

container external gas introducing means for introducing the container external gas which is a source gas or a discharge gas to be generated as a plasma into the sealed space formed of the external electrode and the cover; and

high frequency supply means for supplying a high frequency to the external electrode.

3. A plasma CVD film forming apparatus according to claim 1 or 2, characterized in that the free space of the external electrode is formed in a shape having a portion spaced from an

outer surface of the plastic container when the plastic container is accommodated.

4. A plasma CVD film forming apparatus according to claim 1, 2, or 3, characterized in that the free space of the external electrode is formed in a shape having an inner wall face which comes into contact along a shape of a bottom part of the plastic container when the plastic container is accommodated.

5. A plasma CVD film forming apparatus according to claim 1, 2, or 3, characterized in that the free space of the external electrode is formed in a shape having an inner wall face which comes into contact along shapes of a bottom part and a body part of the plastic container when the plastic container is accommodated.

6. A plasma CVD film forming apparatus according to claim 1, 2, 3, 4, or 5, characterized in that the inner wall face of the external electrode which comes into contact along the shape of the bottom part of the plastic container or the inner wall face of the external electrode which comes into contact along shapes of the bottom part and body part of the plastic container is established in an insulated state from the high frequency supply means.

7. A plasma CVD film forming apparatus according to claim 1, 2, or 3, characterized in that a plastic container support base comprising an insulating body which comes into contact along the shape of the bottom part of the plastic container or the shapes of the bottom part and body part of the plastic container is installed at the inside of the free space.

8. A plasma CVD film forming apparatus according to claim 1, 2, 3, 4, 5, 6, or 7, characterized in that magnetic field generating means such as an inductive coil or a permanent magnet is peripherally provided on an outer wall face of the external electrode.

9. A plasma CVD film forming apparatus according to claim 1, 2, 3, 4, 5, 6, 7, or 8, characterized in that the free space of the external electrode is formed in a shape having a space with a size capable of accommodating a plurality of plastic containers at the same time, the cover supports the internal electrode disposed at every plastic container, and the internal gas introducing means introduces the internal gas in every plastic container.

10. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

in a state in which a container internal gas and a container external gas of a plastic container are not mixed with each other, accommodating the plastic container in a free space of an external electrode compatible with a vacuum chamber and disposing an internal electrode at the inside of the plastic container;

replacing the inside of the plastic container with a source gas and replacing the inside of the free space with a discharge gas; and

supplying a high frequency to the external electrode, generating the source gas and the discharge gas as plasmas to form a CVD film on an inner surface of the plastic container, and carrying out plasma surface modifying such as static

electricity prevention of an outer surface of the plastic container or improvement of applicability to outer face printing.

11. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

accommodating a plastic container in a free space of an external electrode having a hollow shape with bottom, and abutting a mouth part of the plastic container with a mouth part opening provided at a cover for sealing an opening of the external electrode in an intimate contact state such that a container external gas and a container internal gas are not mixed with each other, thereby forming a sealed space with the external electrode and the cover;

replacing the inside of the plastic container with a source gas and replacing the inside of the sealed space with a discharge gas; and

supplying a high frequency to the external electrode, generating the source gas and the discharge gas as plasmas to form a CVD film on an inner surface of the plastic container and carrying out plasma surface modifying such as prevention of static electricity on an outer surface of the plastic container or improvement of applicability to outer face printing.

12. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

in a state in which a container internal gas and a container external gas of a plastic container are not mixed with each other, accommodating the plastic container in a free space of an external electrode compatible with a vacuum chamber and disposing an

internal electrode at the inside of the plastic container;

replacing the inside of the plastic container with a discharge gas and replacing the inside of the free space with a source gas; and

supplying a high frequency to the external electrode, generating the discharge gas and the source gas as plasmas to form a CVD film on an outer surface of the plastic container and carrying out plasma surface modifying such as sterilization of an inner surface of the plastic container or improvement of wetting properties.

13. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

accommodating a plastic container in a free space of an external electrode having a hollow shape with bottom, abutting a mouth part of the plastic container with a mouth part opening provided at a cover for sealing an opening of the external electrode in an intimate contact state such that a container external gas and a container internal gas are not mixed with each other and disposing an internal electrode at the inside of the plastic container to form a sealed space with the external electrode and the cover;

replacing the inside of the plastic container with a discharge gas and replacing the inside of the sealed space with a raw material; and

supplying a high frequency to the external electrode, generating the discharge gas and the source gas as plasmas to form a CVD film on an outer surface of the plastic container

and carrying out plasma surface modifying such as sterilization of an inner surface of the plastic container or improvement of wetting properties.

14. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

in a state in which a container internal gas and a container external gas of a plastic container are not mixed with each other, accommodating the plastic container in a free space of an external electrode compatible with a vacuum chamber and disposing an internal electrode at the inside of the plastic container;

replacing the inside of the plastic container and the inside of the free space with a source gas; and

supplying a high frequency to the external electrode and generating the source gas as a plasma to form CVD films on an inner surface and an outer surface of the plastic container at the same time.

15. A method for manufacturing a CVD film coated plastic container, characterized by comprising the steps of:

accommodating a plastic container in a free space of an external electrode having a hollow shape with bottom, abutting a mouth part of the plastic container with a mouth part opening provided at a cover for sealing an opening of the external electrode in an intimate contact state such that a container external gas and a container internal gas are not mixed with each other and disposing an internal electrode at the inside of the plastic container to form a sealed space with the external electrode and the cover;

replacing the inside of the plastic container and the inside of the sealed space with a source gas; and

supplying a high frequency to the external electrode and generating the source gas as a plasma to form CVD films on an inner surface and an outer surface of the plastic container at the same time.

16. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, or 15, characterized in that, when a high frequency is supplied to the external electrode, a bottom part of the plastic container receives a high frequency from an inner wall face of the external electrode which comes into contact along a shape of the bottom part to generate a self bias voltage, and a neck part, a shoulder part, and a body part of the plastic container receive a high frequency when the container external gas generated as a plasma is defined as an electrically conducting body to generate a self bias voltage and to ignite plasmas as fires at the inside and outside of the plastic container.

17. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, or 15, characterized in that, when a high frequency is supplied to the external electrode, a bottom part and a body part of the plastic container receive a high frequency from an inner wall face of the external electrode which comes into contact along shapes of the bottom part and body part to generate a self bias voltage, and a neck part and a shoulder part of the plastic container receive a high frequency when the container external gas is

defined as an electrically conducting body to generate a self bias voltage and to ignite plasmas as fires at the inside and outside of the plastic container.

18. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, or 15, characterized in that, an inner wall face of the external electrode which comes into contact along a shape of a bottom part of the plastic container or an internal wall face of the external electrode which comes into contact along shapes of the bottom part and body part of the plastic container is established in an insulated state from a high frequency.

19. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, or 15, characterized in that an insulating body coming into contact along a shape of a bottom part of the plastic container or shapes of the bottom part and body part of the plastic container is installed at the inside of the free space, and the bottom part of the plastic container or the bottom part and body part of the plastic container are established in an insulated state from a high frequency.

20. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, 15, 16, 17, 18, or 19, characterized by comprising the steps of:

in a state in which a container internal gas and a container external gas of a plastic container are not mixed with each other, accommodating a plurality of plastic containers in a free space of an external electrode compatible with a vacuum chamber and

disposing an internal electrode at the inside of the each plastic containers;

replacing the inside of the each plastic container with a container internal gas which is a source gas or a discharge gas and replacing the free space with a raw material or a discharge gas; and

supplying a high frequency to the external electrode and generating the container internal gas and the container external gas as plasmas to form CVD films on at least either of inner surfaces and outer surfaces of the plurality of plastic containers at the same time.

21. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, 15, 16, 17, 18, or 19, characterized by comprising the steps of:

accommodating a plurality of plastic containers in a free space of an external electrode having a hollow shape with bottom, abutting a mouth part of the each plastic container with each of a plurality of mouth part openings provided at a cover for sealing an opening of the external electrode in an intimate contact state such that a container external gas and a container internal gas are not mixed with each other and disposing an internal electrode at the inside of each of the plastic containers to form a sealed space with the external electrode and the cover;

replacing the inside of the each plastic container with a container internal gas which is a source gas or a discharge gas and replacing the sealed space with a container external gas which is a source gas or a discharge gas;

supplying a high frequency to the external electrode, and generating the container internal gas and the container external gas as plasmas to form CVD films on at least either of inner surfaces and outer surfaces of the plurality of plastic containers.

22. A method for manufacturing a CVD film coated plastic container according to claim 10, 11, 12, 13, 14, 15, 16, 17, 18, 19, 20, or 21, characterized in that a hydrocarbon based gas or a Si-containing hydrocarbon based source gas is used as the source gas to form a DLC (Diamond Like Carbon) film as a CVD film.